CHANNEL STATE INFORMATION (CSI) REPORT SUBSETS UNDER FLEXIBLE TIME DIVISION DUPLEX (TDD) UL/DL CONFIGURATION

BACKGROUND

[0001] 1. Field

[0002] Embodiments of the invention generally relate to wireless communications networks, such as, but not limited to, the Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Network (UTRAN) and/or Long Term Evolution (LTE) Evolved UTRAN (E-UTRAN). Some embodiments may relate to flexible Time Division Duplex (TDD) configuration in LTE-Advanced (LTE-A).

[0003] 2. Description of the Related Art

[0004] Universal Mobile Telecommunications System (UMTS) Terrestrial Radio Access Network (UTRAN) refers to a communications network including base stations, or Node Bs, and radio network controllers (RNC). UTRAN allows for connectivity between the user equipment (UE) and the core network. The RNC provides control functionalities for one or more Node Bs. The RNC and its corresponding Node Bs are called the Radio Network Subsystem (RNS).

[0005] Long Term Evolution (LTE) or E-UTRAN refers to improvements of the UMTS through improved efficiency and services, lower costs, and use of new spectrum opportunities. In particular, LTE is a 3GPP standard that provides for uplink peak rates of at least 50 megabits per second (Mbps) and downlink peak rates of at least 100 Mbps. LTE supports scalable carrier bandwidths from 20 MHz down to 1.4 MHz and supports both Frequency Division Duplexing (FDD) and Time Division Duplexing (TDD).

[0006] As mentioned above, LTE is also expected to improve spectral efficiency in 3G networks, allowing carriers to provide more data and voice services over a given bandwidth. Therefore, LTE is designed to fulfill future needs for high-speed data and media transport in addition to high-capacity voice support. Advantages of LTE include high throughput, low latency, FDD and TDD support in the same platform, an improved end-user experience, and a simple architecture resulting in low operating costs.

[0007] Further releases of 3GPP LTE (e.g., LTE Rel-10, LTE-Rel-11) are targeted towards future international mobile telecommunications advanced (IMT-A) systems, referred to herein for convenience simply as LTE-Advanced (LTE-A).

[0008] LTE-A is, in part, directed toward extending and optimizing the 3GPP LTE radio access technologies to provide higher data rates and lower latency with reduced cost. LTE-A will be a more optimized radio system fulfilling the international telecommunication union-radio (ITU-R) requirements for IMT-Advanced while keeping the backward compatibility.

SUMMARY

[0009] One embodiment is directed to a method including designating all subframes in a time division duplex configuration as downlink subframes, with the exception of any subframes scheduled for uplink data and control transmission. The method may further include monitoring downlink control channels in the subframes designated as downlink subframes, and defining at least two different channel state information (CSI) report subframe subsets according to interference levels.

[0010] Another embodiment includes an apparatus which may include at least one processor and at least one memory comprising computer program code. The at least one memory and the computer program code may be configured, with the at least one processor, to cause the apparatus at least to designate all subframes in a time division duplex configuration as downlink subframes, with the exception of any subframes scheduled for uplink data and control transmission, to monitor downlink control channels in the subframes designated as downlink subframes, and to define at least two different channel state information (CSI) report subframe subsets according to interference levels.

[0011] Another embodiment may include a computer program, embodied on a computer readable medium. The computer program may be configured to control a processor to perform a process including designating all subframes in a time division duplex configuration as downlink subframes, with the exception of any subframes scheduled for uplink data and control transmission, monitoring downlink control channels in the subframes designated as downlink subframes, and defining at least two different channel state information (CSI) report subframe subsets according to interference levels.

[0012] Another embodiment may include an apparatus comprising means for designating all subframes in a time division duplex configuration as downlink subframes, with the exception of any subframes scheduled for uplink data and control transmission, means for monitoring downlink control channels in the subframes designated as downlink subframes, and means for defining at least two different channel state information (CSI) report subframe subsets according to interference levels.

[0013] Another embodiment is directed to a method including receiving at least one channel state information (CSI) report from a user equipment. The at least one channel state information (CSI) report may include at least two different channel state information (CSI) report subframe subsets defined according to the interference levels. The method may further include scheduling the user equipment according to the channel state information (CST) report subframe subsets.

[0014] Another embodiment includes an apparatus which may include at least one processor and at least one memory comprising computer program code. The at least one memory and the computer program code may be configured, with the at least one processor, to cause the apparatus at least to receive at least one channel state information (CSI) report from a user equipment. The at least one channel state information (CSI) report may include at least two different channel state information (CSI) report subframe subsets defined according to the interference levels. The at least one memory and the computer program code may be further configured, with the at least one processor, to cause the apparatus at least to schedule the user equipment according to the channel state information (CSI) report subframe subsets.

[0015] Another embodiment may include an apparatus comprising means for receiving at least one channel state information (CSI) report from a user equipment. The at least one channel state information (CSI) report may include at least two different channel state information (CSI) report subframe subsets defined according to the interference levels. The apparatus may further include means for scheduling the user equipment according to the channel state information (CSI) report subframe subsets.

[0016] Another embodiment may include a computer program, embodied on a computer readable medium. The com-